Climatic Factors Modulating Warm Season Precipitation in Southwest North America
NOAA Award NA06GP0377

Progress Report for no-cost extension period: 1 July 2003-30 June 2004
Request for second year of no-cost extension period: 1 July 2004-30 June 2005

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This report describes progress made during the no-cost extension period for this award. The working hypothesis that provides the foundation for the project is that land surface anomalies (soil moisture, snowpack, vegetation) are important boundary conditions for the continental climate system that may offer the promise of enhanced predictability of warm season climate anomalies. This project aims to explore these boundary conditions in conjunction with observed oceanic interannual variability to improve statistical prediction schemes and provide focused hypotheses for testing using dynamical models.

A one-year no-cost extension to the original 3-year grant period was requested and granted one year ago. Funds are still left in the grant and a second no-cost extension period is requested to complete modeling and observational work in progress.

Summary of research carried out during the past year

(a) Manuscripts

[i] Three refereed manuscripts based on M.S. thesis work supervised by me on monsoon-related land surface processes appeared in print. The grant provided secondary support for these research efforts. The references are:

Etheredge, D., D.S. Gutzler, and F.J. Pazzaglia, 2004: Geomorphic response to seasonal variations in rainfall in southwest North America. *GSA Bulletin*, **116**, 608-616.

Weiss, J., D.S. Gutzler, J.A. Coonrod and C.N. Dahm, 2004: Long-term vegetation monitoring with NDVI in a diverse semi-arid setting, central New Mexico, U.S.A. *J. Arid Environments*, **58**, 248-271.

Weiss, J., D.S. Gutzler, J.A. Coonrod and C.N. Dahm, 2004: Seasonal and interannual relationships between vegetation and climate in Central New Mexico, U.S.A. *J. Arid Environments*, in press.

[ii] A NOAA/NCEP Atlas was completed and published online describing the NAMAP model assessment analysis headed by the PI. The reference is

Gutzler, D.S., H.-K. Kim, R. W. Higgins, H. Juang, M. Kanamitsu, K. Mitchell, E. Ritchie, J.-K. Schemm, S. Schubert, R. Yang, K. Mo, Y. Song, and P. Pegion. North American Monsoon Model Assessment Project (NAMAP). NCEP/Climate Prediction Center ATLAS No. 11, 32 pp.+Figures, Feb 2004 Available from NOAA Climate Prediction Center, 5200 Auth Road, Camp Springs MD, 20746 and online at http://www.cpc.ncep.noaa.gov/research_papers/ncep_cpc_atlas/11/atlas11.html

[iii] I wrote a short invited, but unrefereed, article on Southwest droughts for the New Mexico Bureau of Geology. This article appeared in an annual volume distributed to state policymakers each year, focusing on an environmental issue of critical social or economic importance for the state. Last year's theme was water resources. The reference is:

Gutzler, D.S., 2003: Drought in New Mexico: History, Causes and Future Prospects. In *Water Resources of the Lower Pecos Region, New Mexico*, NM Bureau of Geology and Mineral Resources (P. Johnson, L. Land, L.G. Price and F. Titus, editors), p.101-105.

[iv] A manuscript was submitted to the *Journal of Climate* last autumn and has been accepted pending minor revision. The reference is:

Gutzler, D.S., 2004: An index of interannual precipitation variability in the core of the North American monsoon region. *J. Climate*, accepted for publication.

[v] A review paper on the North American monsoon system is being prepared by VAMOS scientists, including, myself, in conjunction with the upcoming CLIVAR conference. The reference is:

Vera, C., R.W. Higgins, J. Amador, T. Ambrizzi, R. Garreaud, D. Gochis, D.S. Gutzler, D. Lettenmaier, J. Marengo, C.R. Mechoso, J. Nogues-Paegle and C. Zhang, 2004: A unified view of the American monsoon systems. In preparation for submission to *J. Climate*.

(b) Analysis of model results for the North American Monsoon Experiment

The Editor of the *Bulletin of the American Meteorological Society* has endorsed a proposal from me to write a short manuscript for *BAMS* on the NAMAP analysis and how NAMAP fits into the overall strategy for integrating modeling with a field-oriented process study. This manuscript will be written and submitted for review early in the summer. Also, a second phase of NAMAP is now being considered in conjunction with the 2004 NAME field campaign.

(c) Diagnostics of observed interannual and decadal precipitation variability

With the completion of the *J. Climate* paper (manuscript iv above) I have started to turn back to issues of mixed interannual and decadal variability, and implications of decadal variability for realization of S-I predictability. I am reassessing some of the PDO influences on ENSO-related variability for the summer season calculated as part of earlier research carried out under this grant, and am considering the possible joint influence of Atlantic and Pacific decadal modes, plus land surface feedbacks, on interannual variability of summer precipitation across the Southwest.

(d) Presentations and travel

Grant-supported research was presented at the July 2003 GAPP PI meeting, the September 2003 CLIVAR PanAm PI meeting, the March 2004 VAMOS panel meeting, and will be presented next month at the International CLIVAR conference (Baltimore). I presented a review of progress on warm season precipitation research at the GAPP meeting, gave this presentation to a colleague (David Gochis) who used it as the basis for a similar presentation at the PanAm meeting. I organized the warm season precipitation discussion at the GAPP meeting and, as PanAm panel chair, was in charge overall of organizing the PanAm meeting later in the year.

Although not directly supported by this grant, I also participated in several US CLIVAR, GAPP, and VAMOS panel meetings: the US CLIVAR Pan American Implementation Panel meeting in August 2003 (Seattle), a US CLIVAR SSC meeting in December 2003 (Lamont-Doherty Earth Observatory, Palisades NY), and the 7th VAMOS panel meeting in March 2004 (Guayaquil). I also participated in the North American Monsoon Experiment SWG meeting in April 2004 (Tucson).

Work plan for no-cost extension period: 1 July 2004-30 June 2005

I request a second, and final, no-cost extension year to expend remaining funds from the grant to bring the analyses outlined above to completion. Tasks to be completed include:

(a) Manuscripts now in progress. Grant funds will support any additional revisions that may be required for the *J. Climate* paper (iv above) and my continued participation in the CLIVAR review paper (v above).

(b) Analyses still in progress.

(i) I will be lead author on a *BAMS* contribution based on the NAMAP analysis (part b above).

(ii) I will move ahead on the interannual/decadal variability analyses and predictability studies described in part (c) above and bring these efforts to completion within the proposed additional no-cost extension period.

(iii) I have been invited to write another climate review article for the New Mexico Bureau of Geology on the climate of New Mexico and I anticipate spending a modest amount of time this summer on this. These papers are widely circulated among nonspecialist audiences across the state and I think such publications are tremendously important for public outreach.

(c) Travel. I will participate in the GAPP PI meeting this August and will use remaining travel funds to support this trip (almost all travel funding left in this grant will be used in late June to support my trip to the Baltimore CLIVAR conference).